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Review

Prevalence of Post-Traumatic Stress Disorder (PTSD) in University Students during the COVID-19 Pandemic: A Meta-Analysis Attending SDG 3 and 4 of the 2030 Agenda

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Abstract: Background: Most universities around the world have been heavily affected by the COVID-19 pandemic, as declared by the World Health Organization (WHO) in March 2020. Many students were isolated at home and underwent a forced transition from face-to-face learning to e-learning, at least in the first few months. The subsequent months and years were typically characterised by a slow return to normal learning under COVID-19 protocols and restrictions. A potential consequence of the lockdowns, social restrictions and changes to learning is the development of PTSD (post-traumatic stress disorder) in university students, affecting their health and well-being (SDG3) and quality of education (SDG4). Materials and Methods: Medline was searched through PubMed for studies on the prevalence of PTSD in university students from 1 December 2019 to 31 December 2021. The pooled prevalence of PTSD was calculated with random-effects models. Results: A total of six studies were included, across which the prevalence of PTSD among university students was 23%. Meta-regression showed that the prevalence of PTSD was significantly higher with older age, but independent of the percentage of women in a study or its methodological quality. Conclusions: Our results suggest that students suffer from PTSD at a moderate rate. Measures are needed to address the mental health issues of university students that have arisen during COVID-19 all around the world.

Keywords: university students; post-traumatic stress disorder; gender; age; countries; COVID-19

1. Introduction

Since 11 March 2020, when the World Health Organization (WHO) declared COVID-19 a pandemic [1], university closures to fight against COVID-19 have affected nearly 190 countries, and all continents worldwide [2]. This prompted a rapid transition to e-learning, for which neither teachers or students were generally prepared [3–5]. After re-opening, educational centres had to implement social distancing measures [6,7] and deal with ever-changing protocols to prevent the spread of the virus [8].

The 2030 Agenda for sustainable development and the achievement of a more just and equitable society set 17 goals, with universities being key contributors to achieving those Sustainable Development Goals (SDGs) [9]. The COVID-19 pandemic has impacted

the health and well-being of people worldwide, not only physically, but also in terms of mental health [10,11], particularly among young people [12,13]. Mental health problems may have prevented students from fully engaging with their education, reducing the quality of their experience, which was already impacted by the transition to e-learning and access issues [14]. This included university students, whose emotional state may have been influenced by teaching methods [15].

Post-traumatic stress disorder (PTSD) commonly occurs after experiencing or witnessing stressful or distressing events [16]. The most prominent symptoms are reliving memories related to the traumatic situation, hypervigilance, impaired cognition, negative mood, and avoidance of situations and places reminiscent of the trauma [16].

Several studies have shown that pandemics, natural disasters, and other loss-of-life events are associated with increased PTSD among students [17–20]. Research among university students suggests that vicarious traumatization [21] via media coverage of COVID-19 [22,23] may have caused some cases of PTSD. In fact, a systematic review of general population studies found that there was more PTSD during the COVID-19 pandemic among young people than among the older population [20]. It is important that attention be paid to post-traumatic stress symptoms, as the syndrome can lead to a lower quality of life and a higher risk of self-harm and suicide [24]. This may be particularly important in university-aged young adults, a group among the general population that especially showed increased rates of depression, anxiety, and suicidal ideation during the pandemic [25,26].

While meta-analyses of the prevalence of anxiety, depression, and stress in university students during the COVID-19 pandemic have been conducted [27], to the best of our knowledge, there has been no meta-analysis on post-traumatic stress during COVID-19 in university students, and this study is, therefore, original work. The present study is a systematic review and meta-analysis on PTSD during the COVID-19 pandemic in university students. We specifically investigate whether gender, age, and country of residence influence post-traumatic stress prevalence among university students during COVID-19. Our research question follows the FINER (Feasible, Interesting, Novel, Ethical, and Relevant) framework [28]. This study will contribute to a global perspective on the post-traumatic stress that university students are experiencing, in order to further address SDGs 3 and 4 of the 2030 Agenda.

2. Materials and Methods

This study was conducted in accordance with the PRISMA guidelines for reporting systematic reviews and meta-analyses [29] (Supplementary Table S1).

2.1. Search Strategy

In accordance with the Campbell Collaboration [30], two researchers (JS and BV) searched for all cross-sectional studies reporting the prevalence of PTSD published from 1 December 2019 to 31 December 2021, using MEDLINE via PubMed. The search terms were:

(covid [tiab] OR covid-19 [tiab] OR coronavirus [tiab] OR SARSCoV-2 [tiab] OR "Coronavirus" [Mesh] OR "severe acute respiratory syndrome coronavirus 2" [Supplementary Concept] OR "COVID-19" [Supplementary Concept] OR "Coronavirus Infections/epidemiology" [Mesh] OR "Coronavirus Infections/prevention and control" [Mesh] OR "Coronavirus Infections/psychology" [Mesh]) AND ("Post-traumatic stress" [Mesh] OR "Posttraumatic stress" [Mesh] OR PTSD [Mesh])

No language restrictions were implemented. References from selected articles were inspected to detect additional potential studies. Any disagreement was resolved by consensus among a third and fourth researcher (NO-E and NI), in accordance with Harrer et al. [31].

Selection Criteria

Studies were included if they: (1) reported cross-sectional data on the prevalence of PTSD, or sufficient information to compute this, conducted during the COVID-19 pandemic; (2) focused on university students; (3) used a validated instrument to assess PTSD; and if (4) the full text was available.

We excluded studies focusing only on community-based samples of the general population, or specific samples that did not include university students (e.g., teachers, medical professionals, patients), as well as review articles.

A pre-designed data extraction form was used to extract the following information: country, sample size, proportion of women, average age, response rate and sampling methods, and also the instruments used to assess PTSD, and PTSD prevalence rates.

2.2. Methodological Quality Assessment

Articles identified for retrieval were assessed by two independent reviewers (IL and JS) for methodological validity before being included in the review, using the Joanna Briggs Institute (JBI) standardized critical appraisal instrument for prevalence studies [32]. Quality was evaluated according to nine criteria, each yielding a score of zero or one. One score was obtained for each criterion if the study was affirmative: 1: Was the sample frame appropriate to address the target population? 2: Were study participants recruited in an appropriate way? 3: Was the sample size adequate? 4: Were the study subjects and setting described in detail? 5: Was data analysis conducted with sufficient coverage of the identified sample? 6: Were valid methods used for the identification of the condition? 7: Was the condition measured in a standard, reliable way for all participants? 8: Was there appropriate statistical analysis? 9: Was the response rate adequate, and if not, was the low response rate managed appropriately?

Any disagreements between the reviewers were resolved through discussion, or by further discussion with the third and fourth researchers (NO-E and NI).

2.3. Statistical Analysis

A generic inverse variance method with a random-effects model was used [33], with double arcsine transformation of proportion to account for the variability and heterogeneity of prevalence rates among the included studies [34]. We used Knapp–Hartung adjustments [35] to calculate the confidence interval for the pooled prevalence. Several studies [36] have shown that this adjustment can reduce the chance of false positives, especially when the number of studies is small. The main outcomes are presented in proportion format with the corresponding 95% confidence interval (95%CI) and 95% prediction interval (95%PrI), along with statistical heterogeneity results. The Hedges Q statistic is reported to check heterogeneity across studies, with statistical significance set at p-value < 0.10. The I^2 statistic and 95%CI were also used to quantify heterogeneity [37]. Values between 25 and 50% are considered as low, 50 and 75% as moderate, and 75% or more as high [38]. Heterogeneity of effects between studies occurs when differences in results for the same exposure–disease association cannot be fully explained by sampling variation. Sources of heterogeneity can include differences in study design or in demographic characteristics. We performed meta-regression and subgroup analyses [39] to explore the sources of heterogeneity expected in meta-analyses of observational studies [40]. We conducted a sensitivity analysis to determine the influence of each individual study on the overall result by omitting studies one by one.

In a meta-analysis of proportion studies, like the current study, a Doi plot and the Luis Furuya–Kanamori (LFK) index are a better approach for graphically representing publication bias than visual inspection of a funnel plot [41] or Egger's test [42]—where a symmetrical triangle implies the absence of publication bias, while an asymmetrical triangle indicates possible publication bias [43]. The Doi plot and LFK index have higher sensitivity and power to detect publication bias than the funnel plot and Egger's regression [44]. The LFK index provides a quantitative measure to assess the degree of asymmetry—scores

within ±1 indicate 'no asymmetry'; exceeding ±1 but within ±2 indicate 'minor asymmetry'; and exceeding ±2 indicate 'major asymmetry'. Additionally, the fail-safe N value was used as an indicator of publication bias [45]. This statistic is recommended when there are less than 10 studies in the meta-analysis [46,47], and it indicates the number of non-significant, unpublished (or missing) studies that would need to be added to reduce an overall statistically significant result to non-significance.

Statistical analyses were conducted by the author JS and run with *R* statistical software [48].

3. Results

3.1. Selection of Studies

Figure 1 shows a flowchart of the search strategy and study selection process. A total of 469 records were initially identified, with 450 excluded after a first screening of the titles and abstracts. After reading the remaining 19 articles in full, we finally included six in our meta-analysis [19,49–53]. Exclusion reasons are detailed in Figure 1.

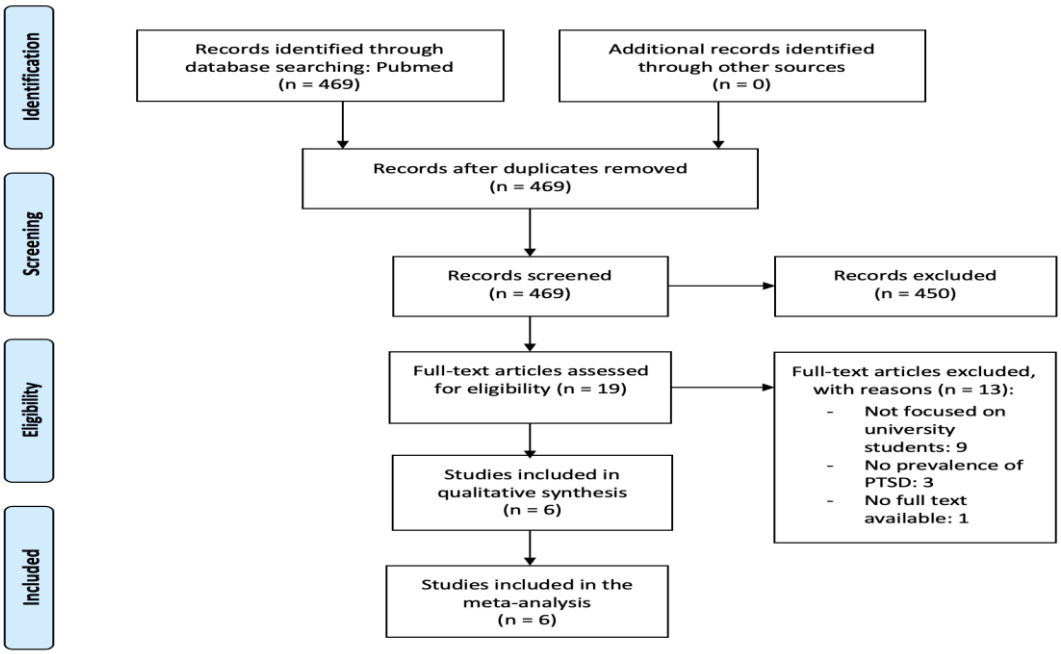

Figure 1. Flowchart of the study search and selection process.

3.2. Characteristics and Methodological Quality of the Included Studies

The characteristics of the six studies included in the meta-analysis are shown in Tables 1 and 2. Table 1 gives a descriptive overview of the overall characteristics, while Table 2 shows the PTSD scale used and the prevalence of PTSD found in each study. Of the studies analysed, three were conducted in China, two in the USA, and one in France. The sample size ranged from 261 [52] to 22,883 participants [53], and the mean age ranged from 19.8 [19] to 20.9 years [53]. While one study [51] had only women participants, the other studies comprised 63.1% women, on average. The response rate was between 29.5% [50] and 89.7% [52]. All studies used standardized and validated scales, and were conducted by using online questionnaires. Of those reporting their sampling methods, one was stratified sampling [51], one snowball [52], and the rest convenience sampling [19,49,50,53].

Table 1. Characteristics of the studies included in the meta-analysis.

First Author (Publication Year)	Sample Country	Sample Size (n)	Mean Age (SD)	Females (%)	Response Rate (%)	Sampling Method	Quality Assessment
Chi et al. (2021) [49]	China	1164	20.6 (1.9)	64.8%	NR	Convenience	4
Lee et al. (2021) [50]	USA	741	NR	63.9%	29.5%	Convenience	4
Si et al. (2021) [51]	China	2205	20.8 (1.5)	100%	NR	Stratified	5
Song et al. (2021) [52]	USA	261	NR	53.3%	89.7%	Snowball	4
Tang et al. (2020) [19]	China	2485	19.8 (1.5)	60.8%	69.3%	Convenience	4
Wathelet et al. (2021) [53]	France	22,883	20.9 (4.1)	72.7%	NR	Convenience	5

Abbreviations: SD, standard deviation; NR, not reported.

Table 2. Outcome assessments of the included studies.

First Author (Publication Year)	Scale	PTSD Assessment Criteria	No. Cases (Prevalence, %)
Chi et al. (2021) [49]	PCL-C	≥14	358 (30.8%)
Lee et al. (2021) [50]	PC-PTSD-5	≥3	188 (25.4%)
Si et al. (2021) [51]	IES-6	≥10	754 (34.2%)
Song et al. (2021) [52]	PCL-C	≥38	98 (37.5%)
Tang et al. (2020) [19]	PCL-C	≥38	67 (2.7%)
Wathelet et al. (2021) [53]	PCL-5	> 32	4,456 (19.5%)

Abbreviations: PCL-C, PTSD Checklist-Civilian; PCL-5, Chinese PTSD Checklist for DSM-5; PC-PTSD-5, Primary care PTSD screen for DSM-5; IES-6, The Impact of Event Scale-6.

Regarding the quality of the studies, the scores ranged from 4 to 5 (Table 3). The main limitation present in all studies was that the absence of PTSD measured by unbiased raters could not be guaranteed, due to using online surveys. In all the studies, the confidence intervals for prevalence were provided, and the study subjects and setting were described.

Table 3. Quality assessment.

Study	1	2	3	4	5	6	7	8	TOTAL
Chi et al. (2021) [49]	0	0	1	1	0	0	1	1	4
Lee et al. (2021) [50]	0	0	1	1	0	0	1	1	4
Si et al. (2021) [51]	1	0	1	1	0	0	1	1	5
Song et al. (2021) [52]	0	0	0	1	0	1	1	1	4
Tang et al. (2020) [19]	0	0	1	1	0	0	1	1	4
Wathelet et al. (2021) [53]	0	1	1	1	0	0	1	1	5

Criteria: (1) random sample or entire population; (2) unbiased sampling frame (census data); (3) adequate sample size (>300 subjects); (4) standard measures were used; (5) outcome measured by unbiased raters; (6) adequate response rate (>70%) and description of losses; (7) confidence intervals and subgroup analysis; (8) study subjects described.

3.3. PTSD Prevalence

The reported prevalence of PTSD data in university students ranged from 3% [19] to 38% [52] (Table 1). Our estimated overall prevalence of PTSD was 23% (95% CI: 13–35%), with significant heterogeneity between studies (Q test: p-value < 0.01; I^2 = 99.6%) (Figure 2). The prediction interval showed that the proportion of PTSD in future similar studies would range between 0% and 70% (Figure 2).

Our subgroup analyses to identify sources of heterogeneity found a higher prevalence of PTSD in studies from the USA (31% [95% CI: 5–67%]) compared to those in China (19% [95% CI: 2–47%]) or France (19% [95% CI: 0–69%]); however, this difference did not reach statistical significance. We also observed lower prevalence of PTSD for studies based on convenience samples (17% [95% CI: 7–31%]), compared with other sampling methods (35% [95% CI: 16-59%]. Our meta-regression showed that the prevalence of PTSD was significantly higher with older mean age at baseline (b = 0.35, p-value = 0.032), and independent of percentage of women (p-value = 0.493) or methodological quality (p-value = 0.735). Insufficient data meant that no subgroup or meta-regression analyses for PTSD scale type and response rate, respectively, were performed.

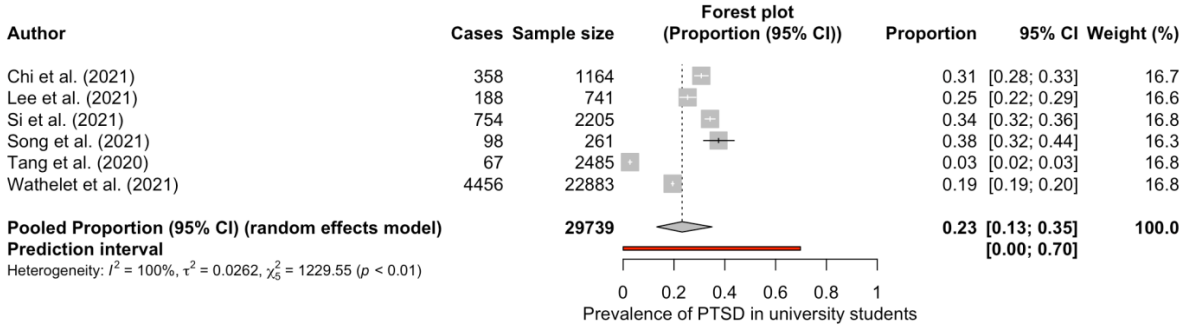

Figure 2. Forest plot for the prevalence of PTSD among university students [19,49–53].

Excluding studies one by one from the analysis did not substantially change the pooled prevalence of PTSD, which varied between 20% (95% CI: 10–33%), with Song et al. [52] excluded, and 29% (95% CI: 21–38%), with Tang et al. [19] excluded (Figure 3). This indicates that no single study had a disproportional impact on the overall PTSD prevalence.

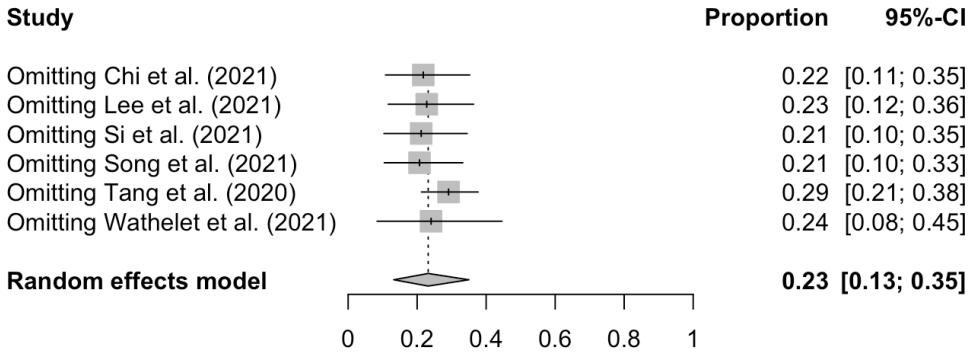

Figure 3. Sensitivity forest plot for the prevalence of PTSD among university students [19,49–53].

Figure 4 depicts the Doi plot and a Luis Furuya–Kanamori (LFK) index of 3.06, indicating 'major asymmetry' and the likely presence of publication bias. However, an absence of publication bias was indicated by a fail-safe N of 8376, indicating that 8376 studies with null results would be needed to reduce the observed overall prevalence to non-significance.

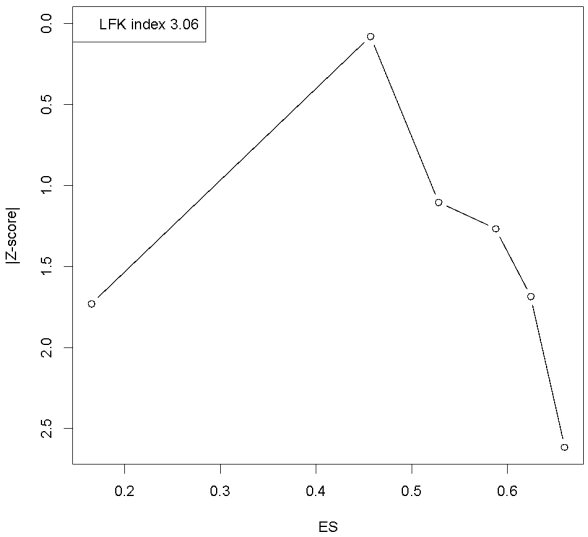

Figure 4. Doi plot for the prevalence of PTSD among university students.

4. Discussion

The present study provides an up-to-date meta-analysis of studies reporting the prevalence of PTSD in university students during the COVID-19 pandemic. Based on a total of six studies, an estimated overall prevalence of PTSD of 23% was found in this population, with clear effects on well-being and health (SDG3) and likely implications for their education (SDG4).

Some previous systematic reviews and meta-analyses have reported on the prevalence of PTSD in the general population, or a mix of the general population and other groups, during COVID-19. The prevalence of PTSD varies across these studies: 15% [54]; 21.9% [55]; 28.3% [56]; as well as a prevalence of 18% for PTSD symptomatology [57].

Previous research has also analysed PTSD in different professional or socio-demographic groups. Studies focusing on healthcare workers have found prevalences of 18% [57], 21.5% [58], 26.9% [59], and 29.2% [56]. Studies focusing on people who have been infected with COVID-19, especially during the first waves of the epidemic, have found prevalences of 23.8% [59], 29% [57], and 36.3% [56], as well as 24.5% for people with suspected cases of COVID-19 [56]. Qui et al. [56] also found a prevalence of 29.39% among a cohort comprising both students and teachers, and without consideration of factors such as educational sector and age. With greater precision, Idoiaga et al. [60] found a prevalence of 10% in teachers and Ozamiz et al. [61] found a prevalence of 14% in schoolchildren. Our finding of a prevalence of 23% among university students is, thus, the closest to the higher prevalence of healthcare workers, or those infected with COVID-19.

We found no significant differences in the prevalence of PTSD between men and women. Our results are, thus, not consistent with other findings in the general population and in other adult cohorts, which indicate that women are at increased risk for PTSD [22,62–67], including during the COVID-19 pandemic [20]. Some studies suggest that women are at a higher risk of PTSD than men because of gender inequality and discrimination [68–70], genetic predisposition and hormonal influences, and individual gender roles [71]. However, similarly to our findings, numerous meta-analyses on various mental health problems among university students during the pandemic have found no gender differences [70,72–76]. This may be because there are fewer differences in family and caregiving burdens between male and female university students than between men and women in either the general population or other cohorts [77,78].

Our analyses of country differences found a higher prevalence of PTSD in the USA than in China or France, though this was not statistically significant. Of the USA-based studies, one focused on international students, and thus away from home [52], while the other focused on medical students [50]. Other research has shown that international and medical students were both more likely to have mental health problems during the COVID-19 pandemic [70,73,75,76]. Finally, we also found that the prevalence of PTSD increased with age, consistent with a previously reported correlation between age and the prevalence of mental health problems among university students during COVID-19 [79,80].

Therefore, this research makes a novel contribution to both existing literature on the COVID-19 pandemic and mental health, and to the literature on PTSD. Firstly, as previously stated, we have found that the levels of PTSD among university students are some of the highest found within the groups analysed [56,59,81]. They are also close to the levels of other symptomatologies, such as stress, depression or anxiety [4,27,72,82]. Therefore, this research confirms that we are facing a very important mental health problem among young people.

On the other hand, with respect to the literature on PTSD, this study has found levels of PTSD much higher (almost seven points) than those previously found among young people seeking or receiving mental health treatment [83]. This marks a clear trend in how this symptomatology has expanded among this group, a risk that had already been noted before the pandemic [84]. It also reaffirms that the pandemic has been a universal cause of the spread of PTSD, and joins other causes that have previously been analysed, such as war, abuse, violence, etc. [85–87].

Strengths and Limitations

To our knowledge, this is the first meta-analysis focusing on PTSD during COVID-19 among university students. While the number of studies included was small, there is evidence that meta-analyses of a few papers can establish valid conclusions [88]. Other potential limitations of our findings are that all studies used online surveys to assess PTSD, and most used convenience samples, rather than more representative sampling methodologies. It was also the case that the quality of the included sample was moderate-to-low, possibly a consequence of the difficulties in conducting such research under COVID-19 conditions. Finally, another limitation of the study was that we only used PubMed, which decreases sensitivity; however, according to Falangas et al. [89], Medline covers a good part of the potentially eligible studies.

5. Conclusions

This study shows that the mental health of university students has clearly been affected during the COVID-19 pandemic, with around one in four having experienced PTSD.

Having a quarter of university students experiencing PTSD should not go unnoticed by university communities, who should promote interventions that improve the well-being of these students [90]. This is addressed by the 2030 Agenda, which states that quality education (SDG4) must be achieved among university students, and for which it is essential that they enjoy physical and mental health and wellbeing (SDG3). Taking care of university students' mental health can also prevent psychological problems developing in later adulthood and during professional life [4].

The Sustainable Development Goals (SDGs) are a working agenda for the international community to ensure a better world for future generations, with academics being an important focus [91]. It is, therefore, important to work on these SDGs, as they are important for the university students [92].

Therefore, the implications of the present study are to provide tools and services to care for the mental health of university students, making an important economic contribution to mental health. In this way, they will also improve their academic performance.

This research is necessary because it is important to visualize the mental state of university students in the period of COVID-19, in order to further improve it and invest in it.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su14137914/s1, Table S1: PRISMA Checklist.

Author Contributions: Conceptualization, J.S., N.I., D.M.L. and N.O.-E.; methodology, J.S., B.V., N.I., I.L. and N.O.-E.; writing—original draft preparation, J.S, N.I. and N.O.-E. All authors have read and agreed to the published version of the manuscript.

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